

Claim Listing

1. (Original) An apparatus comprising:

an optical die flip-chip bonded to a substrate and defining a volume between the optical die and the substrate, the optical die including an optically active area on a surface of the die facing the substrate;

an optically transparent material occupying at least those portions of the volume substantially corresponding with the optically active area; and

an underfill material occupying portions of the volume not occupied by the optically transparent material.

2. (Original) The apparatus of claim 1 wherein the optically active area is a detector or a source.
3. (Original) The apparatus of claim 1 wherein the optically transparent material has a low modulus of elasticity.
4. (Original) The apparatus of claim 1 wherein the optically transparent material is optically transparent at wavelengths between 800 nm and 1550 nm.
5. (Original) The apparatus of claim 4 wherein the optically transparent material is optically transparent at a wavelength of approximately 850 nm.
6. (Original) The apparatus of claim 1 wherein the optically transparent material has a refractive index of approximately 1.5.
7. (Original) The apparatus of claim 1 wherein the optically transparent material is an adhesive.
8. (Original) The apparatus of claim 7 wherein the optically transparent material is silicone-based.
9. (Original) An apparatus comprising:

an optical die flip-chip bonded to a substrate and defining a volume between the optical die and the substrate, the optical die including an optically active area on a surface of the die facing the substrate;

an optical component partially positioned in the volume between the optical die and the substrate to carry an optical signal to or receive an optical signal from the optically active area;

an optically transparent material occupying those portions of the volume substantially between the optically active area and the optical component; and

an underfill material occupying portions of the volume not occupied by the optically transparent material and the optical component.

10. (Original) The apparatus of claim 9 wherein the optical component is a waveguide.
11. (Original) The apparatus of claim 9 wherein the optically active area is a detector or a source.
12. (Original) The apparatus of claim 9 wherein the optically transparent material has a refractive index substantially the same as a refractive index of the optical component.
13. (Original) The apparatus of claim 9 wherein the optically transparent material has a refractive index of approximately 1.5.
14. (Original) The apparatus of claim 9 wherein the optically transparent material has a low modulus of elasticity.
15. (Original) The apparatus of claim 9 wherein the optically transparent material is optically transparent at wavelengths between 800 nm and 1550 nm.
16. (Original) The apparatus of claim 15 wherein the optically transparent material is optically transparent at a wavelength of approximately 850 nm.
17. (Original) The apparatus of claim 9 wherein the optically transparent material is an adhesive.
18. (Original) The apparatus of claim 9 wherein the optically transparent material is silicone-based.
19. (Original) A system comprising:

a signal source;

a first optical die coupled to the signal source, the first optical die being flip-chip bonded to a substrate and defining a first volume between the first optical die and the substrate, the first optical die including an optically active area on a surface of the die facing the substrate;

a signal destination;

a second optical die coupled to the signal destination, the second optical die being flip-chip bonded to a substrate and defining a second volume between the second optical die and the substrate, the second optical die including an optically active area on a surface of the die facing the substrate;

an optical component extending between the first and second optical dies, the optical component partially positioned in the first and second volumes;

an optically transparent material occupying those portions of the first and second volumes substantially between the optically active areas and the optical component; and

an underfill material positioned in the portions of the first and second volumes, the underfill material occupying portions of the volume not occupied by the optically transparent material.

20. (Original) The system of claim 19 wherein the optical component is a waveguide.
21. (Original) The system of claim 19 wherein the optically active area of the first die is a source and the optically active area of the second die is a detector.
22. (Original) The system of claim 19 wherein the optically transparent material has a refractive index substantially the same as a refractive index of the optical component.
23. (Original) The system of claim 19 wherein the optically transparent material has a refractive index of approximately 1.5.
24. (Original) The system of claim 19 wherein the optically transparent material has a low modulus of elasticity.
25. (Original) The system of claim 19 wherein the optically transparent material is optically transparent at wavelengths between 800 nm and 1550 nm.

26. (Original) The system of claim 25 wherein the optically transparent material is optically transparent at a wavelength of approximately 850 nm.

Claims 27-46. (Canceled)